SYNOPSIS

IIMT University, Meerut

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Surfactant in remediation for the removal of oil - spills; An effective tool for controlling the oil product contamination.
(A comparative study with reference to different surfactants and their effectiveness on the remediation of different study material)

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Contents

1 INTRODUCTION 3
2 Objective:- 5
3 Plan of work:- 6
4 Methodology:- 6
4.1 Characterization and analyses the surfactant: 7
4.2 Emulsion preparation: 7
4.3 Conductivity measurements: 7
4.4 Measurement of surface tension: 7
4.5 Dynamic light scattering (DLS) measurement: 8
4.6 Emulsion stability detection: 8
4.7 Toxicity detection: 8
5 Review of literature:- 8
6 Summary:- 10
7 References: 10

Contents of Synopsis

- Introduction
- Objective of your work and hypotheses
- Plan of work
- Methodology
- Literature review
- Bibliography or references

- Summary

1 INTRODUCTION

According to the modern world petroleum is a form of entire energy, which is used in highly professional works like jet fuel, gasoline, and other energy sources all over the world. It also has a big demand all over the world. Oil is one of the sources of energy used in various fields like industries and transportation. It is Hydrocarbon that is found in different forms like crude oil and petroleum also. But it also causes pollution when the tankers and pipelines of oil are damaged. According to many researchers, oil spilling is spread on water, land, and air also. So it causes overall environmental pollution. According to the knowledge of the Energy Information Administration of US, the consumption of petroleum in Asian part is increasing due to more demand.

The spilling of oil on land affects the quality of groundwater. In the same way, oil spills on the water are so hazardous it affects marine life and the ecosystem of water. After the evaporation process, some droplets spread in the wind and pollute the environment. [1] [2]. It affects human eyes, skin irritation and also produces breathing problems [3]. Oil transportation through shipping, dumping and drains causes a big problem of oil spilling in the entire oceans. And also has many treatment methods of oil dispersion. Now oil spill treatment process is divided as mechanical, chemical and biological methods [4]. Due to the increasing demand of energy and nonrenewable sources of petroleum, recovery of oil spill is most important. The surfactant has the special characteristics of forming micelle structure that hold the oilec diet through a process of emulsification. For absorbing the spilled oil from the surface of water it is advised to use the adsorbent and surfactants. Other than this different type of methods are used to remove oil spills like booms(burning), skimming and hydrophobic meshes are some physical techniques that are used for removal of emulsified or floating oil from the surface of water. [5] [6] [7].

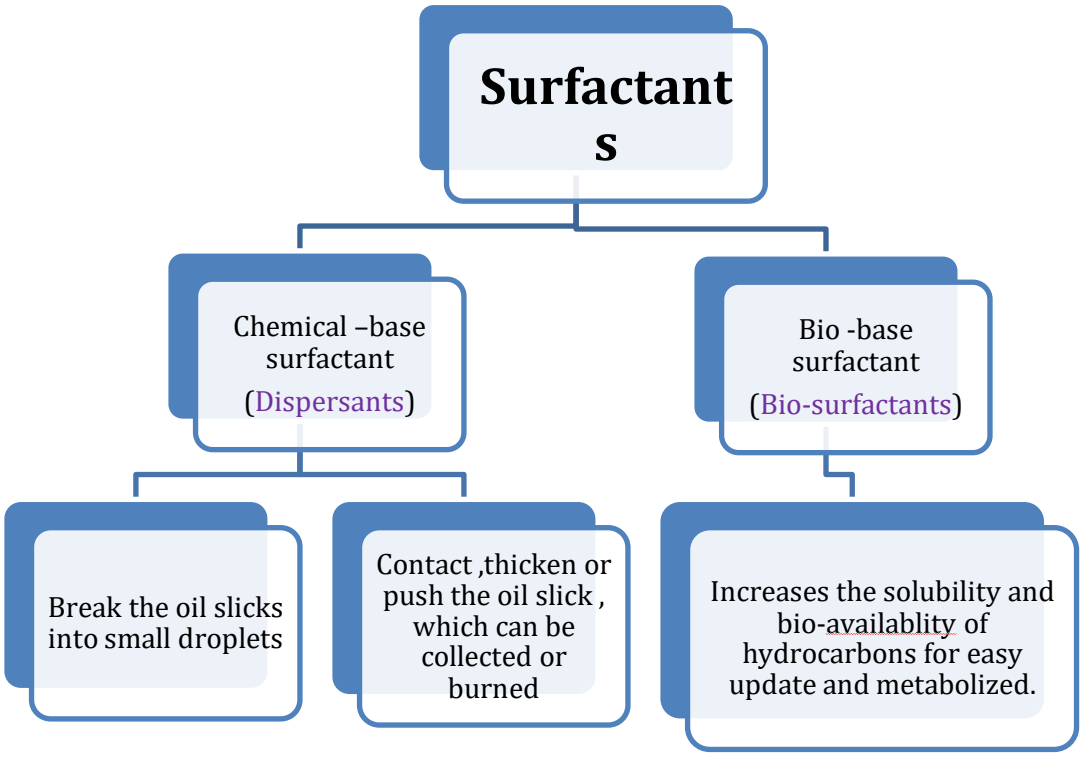
Surfactant s
Chemical –base surfactant (Dispersants)
Bio -base surfactant (Bio-surfactants)
Break the oil slicks into small droplets
Contact ,thicken or push the oil slick , which can be collected or burned
Increases the solubility and bio-availablity of hydrocarbons for easy update and metabolized.

Fig. -1 Different working process of surfactant.

The types of surfactant and its working process is shown in Fig.1. Like- Chemical based surfactants and Bio-surfactants. Both are used for removal of oil spills in different manner.

Another then this in biological methods like oxygen stimulants and microbes is used in the biodegradation of oil spill. [8]. Focusing on chemical method dispersants are widely used, which is spread to affected areas for the treatment of oil spills. This method is expected to eco -friendly and recyclable. [9]. Firstly, ensure that the dispersants must have highly absorption ability, hydrophobic property, recyclable and biodegradable. Same as chorisias peciosa has high oleophilic and hydrophobic quality which is absorbent in a day in wet conditions also.

All Hydrocarbons are non-polar so mainly the oil have non-covalent interaction with sorbent now with the help of capillary action and adsorption process, oil is removed from the surface. Now according to surface chemistry, the measurement of wettability of water on the flat surface of the sorbent is determined. In this process the contact angle of a flat surface and water droplet is measured. If angle is between 90º and 150º then it is hydrophobic, if less than 90º then hydrophilic, at last it is more than 150º it is more hydrophobic then it is easier to remove from water surface. For example – Lotus leaves [10].

After this according to chemical method, cationic and anionic surfactants are used because they are easily made them absorbed on the surface onto oppositely charged surfaces due to ion exchange. In various chemical industries have a big problem of (WFO) waste frying oil in every day it also resolved through cationic surfactant use. Mainly used vegetable oils are used for the extraction of Fatty acids such as palmatic acid; oleic acid, linoleic etc. represent the raw material for producing surfactants which easily decreases the cost of production as WFO. It's easily detected through the techniques like IR and NMR spectra [11].

After all this, every researcher thinks about the toxicity of chemical surfactant. In Mexico Gulf oil spill, Corexit 9500A and Corexit9527A two main dispersants were used which cause various toxicity issues. Corexits mainly had a mixture of hydrocarbons (60%-100%), organic sulfonic acid salts (10-30%) and propylene glycol (1-5%)[12]. After all this to enhance the effect of surfactant with low toxic effect on aquatic life a binary mixture of a bio-surfactant and ionic liquid surfactant is also produced.

2 Objective:-

1. The main objectives of the present study are ;
   i. To use the surfactant in remediation for the removal of oil spills; an effective tool for controlling the oil product contamination (kitchen waste) in water bodies.
   ii. To synthesized surfactants and their effectiveness on different study materials.
   iii. To study the biodegradable nature and oil recovery efficiency of synthesized

surfactants Vs commercially available surfactants.

3 Plan of work:-

Whole work is divided into three-four phase.

Phase -1 -For the detection of oil spills concentration or hydrocarbon chain mainly used the gas chromatography process, and selects to appropriate surfactant which is less toxic and more effective on oil waste material. Means the characterization of special surfactant, it may be ionic and non ionic.

Phase – II- Observed and notify the improvement effect of surfactant on oil waste and micellization. Emulsification of oil water system in the presence of surfactant.

Phase - III- Absorption studies of surfactant on waste water solution.

Phase- IV- At last focus on application of this process to reduce water pollution and reuse the kitchen or industrial waste in different works.

Mainly focused on eco-friendly process, so trying to use less toxic or degradable surfactants. Cationic surfactants gave antibacterial activity also and show excellent activity with oil spills.

4 Methodology:-

As discussed earlier physical, chemical and biological methods are widely used for the recovery of oil from the surface of environment like using oil booms, skimmers, burning process, using dispersants, bioremediation and natural recovery also. In all these method

only dispersants are mainly used on higher demand because it reacts faster and less time taking method. Dispersants are also given instant effect to reduce the size of oil spills. It affect the marine life but some naturally synthesized surfactants, which are prepared from the esterification of vegetable found in the research field, which is very helpful to show less toxic effect after the cleanup.

Now the dispersant method is used for the treatment of oil spilling, and the following processes are involved in this method:-

4.1 Characterization and analyses the surfactant:

For the detection of functional group of some analytical method are used like gas chromatography with mass spectrometry (GC-MS) and FTIR. Which help to detect the affect of surfactant on oil.

4.2 Emulsion preparation:

Oil and water emulsion must be prepared with adding 1:10 ratio of oil and water. Then a suitable amount of dispersant is added to the sample. After few minutes emulsion stability to be checked and observed it.

4.3 Conductivity measurements:

The electrical conductivity of any solution is depending upon the mobility of ions or charged particles present in the solution. So in case of ionic surfactants, electrical conductivity increases with the concentration of surfactant and the formation of micelles affect the conductivity of an ionic solution. So the critical micelle concentration is measured through the conductivity versus surfactant concentration curve.

4.4 Measurement of surface tension:

Sample with different mole fraction of dispersant and the surface tension of each aqueous

mixture is observed. More than two or three success readings will be recorded for accuracy. After this interfacial tension also measured for the analysis of drop shape and size.

4.5 Dynamic light scattering (DLS) measurement:

This assembly is used to determine the average size of the dispersed oil droplets at a constant temperature. In this technique, the diffusion of particles moving under Brownian motion is measured.

4.6 Emulsion stability detection:

According to amphiphilic property of surfactant it easily solubilized the water in non-polar liquids (oils). Surfactants process an important property of emulsification. The oil in water emulsion is formed through surfactants. According to CMS the stability time of surfactant is observed. And the stability of micelle is finally observed.

4.7 Toxicity detection:

Most commonly test for the toxicity detection is observed on the plants test. In which the effect of surfactant after process is determine through the changes found in plants. Because it must to maintain the ecosystem of aquatic life.

5 Review of literature:-

The study of bio based sorbents for reducing the oil content from water with feasible and eco friendly changes, and after that a review of bio based materials for oil spill treatment. Now according to surface chemistry the measurement of wettability of water on the flat surface of the sorbent is determined [13]. For determine the particle behavior in emulsification and adsorption process the contact angle of a flat surface and water droplet is measured. If angle is between 90º and 150º then it is hydrophobic, If less than 90º then

hydrophilic, at last it is more than 150º it is more hydrophobic then it is easier to remove from water surface. For example – Lotus leaves [14]. After this when define the classification of surfactants and discussed the physical, chemical or biological methods.

According to new researches in chemical surfactants area, cationic surfactant also react easily because the positive charge of cationic surfactant easily attached with oil surface [15]. Cationic surfactant is also used in the treatment of WFO waste frying oil in various chemical industries also [16]. Due to high cost and chemical effect of surfactant some natural surfactants are also synthesized through fatty acids which are extracted from vegetable oils [17], and its methodology is also defined well with the use of different spectroscopy tools.

After all this, every researcher thinks about the toxicity of chemical surfactant, BBDs (Bio-surfactant based dispersants) may be more environment friendly than surfactant currently used. Like in Alaska North Slope crude oil mainly used the four BBDs, i.e. Sufactins, trehhalose lipids, exmulsins and rhamnolipids in compare with widely used commercial oil dispersant Corexit 9500A. However, blends of all these surfactants had good result increase dispersant performance and biodegradation rate and with toxicity [18] [19].

A binary mixture of an ionic liquid surfactant and a bio-surfactant resist the toxicity and work as green dispersant for oil spill remediation. Like a binary mixture of ionic liquid surfactant, Choline Laurate ([Cho][Lau]), and a biosurfactan, Lactonicsophorolipid (SLs). It origin effective dispersion of spills with non toxic effect. In these surface active ionic liquids (SAILs) and choline cation are being actively researched due to their low toxicity and high biodegradability. According to the researchers on 40:60 ([Cho][Lau]) : [LSs] ratio the highest dispersant effectiveness is about 83% [20].

6 Summary:-

In this process the main motive is to reduced and degrades the oil stuff from kitchen water waste with non toxic effect of surfactants, so the dispersant must be biodegradable, so the comparative study of different process or surfactants is important. And the process will be used for small and large prospective, Like in food industries and canteens also. After the whole process toxic effect is measured, because at last the waste water is also used for other purposes like irrigation or cleaning. So it must be non toxic or biodegradable.

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